

# Package ‘rSQM’

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**Type** Package

**Title** Statistical Downscaling Toolkit for Climate Change Scenario  
using Non Parametric Quantile Mapping

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**Description** Conducts statistical downscaling of daily CMIP5 (Coupled Model Intercomparison Project 5) climate change scenario data at a station level using empirical quantile mapping method by Jaepil Cho et al. (2016) <doi:10.1002/ird.2035>.

**License** GPL (>= 2)

**LazyData** TRUE

**RoxygenNote** 6.0.1

**Depends** R (>= 3.3.0)

**Imports** ncd4, zoo, stringr, EcoHydRology, dplyr, gsubfn, yaml, mise,  
reshape2, qmap, ggplot2

**Suggests** knitr, rmarkdown, testthat

**NeedsCompilation** no

**VignetteBuilder** knitr

**Repository** CRAN

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DailyExtractAll	<i>Extract daily time series</i>
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## Description

Extract daily time series for every combination of variables, GCM models, and RCP scenarios as text format

## Usage

```
DailyExtractAll(cmip5dir, stndir, stnfile, qmapdir, SimAll, ModelNames,
                RcpNames, VarNames, OWrite)
```

## Arguments

cmip5dir	directory name containing daily CMIP5 data as NetCDF format
stndir	directory name containing station information file
stnfile	file name for station information
qmapdir	directory name for storing extracted daily time series output
SimAll	logical. TRUE then process goes over all the scenarios available
ModelNames	string vector contains climate change scenario models to be used
RcpNames	Rcp names to be used such as rcp45, rcp85
VarNames	variable to be used such as prcp(precipitation), tmax/tmin, solar radiation, wind etc
OWrite	Flag for overwriting output files (T: Overwrite, F: Skip)

## Examples

```
## Not run:
rSQMSampleProject()
## Step 1. Set working environment
EnvList <- SetWorkingEnvironment(envfile = "rSQM.yaml")
## Step 2. Load climate scenario data
LoadCmip5DataFromAdss(dbdir = EnvList$dbdir, NtlCode = EnvList$NtlCode)
## Step 3. Extract daily time series
DailyExtractAll(
  cmip5dir = EnvList$cmip5dir,
  stndir = EnvList$stndir,
  stnfile = EnvList$stnfile,
  qmapdir = EnvList$qmapdir,
  SimAll = EnvList$SimAll,
```

```

ModelNames = EnvList$ModelNames,
RcpNames = EnvList$RcpNames,
VarNames = EnvList$VarNames,
OWrite = EnvList$OWrite)

## End(Not run)

```

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DailyQMapAll

*Quantile mapping bias-correction*


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### Description

Do bias-correction using quantile mapping and save the bias-corrected outputs for each weather station.

### Usage

```

DailyQMapAll(stndir, stnfile, qmapdir, prjdir, SimAll, RcpNames, VarNames,
  syear_obs, eyear_obs, syear_his, eyear_his, syear_scn, eyear_scn, OWrite,
  SRadiation)

```

### Arguments

stndir	directory path for station information file
stnfile	file name for station information
qmapdir	directory path for bias-corrected output files
prjdir	directory path for project
SimAll	logical. TRUE then process goes over all the scenarios available
RcpNames	Rcp names to be used such as rcp45, rcp85
VarNames	variable to be used such as prcp(precipitation), tmax/tmin, solar radiation, wind etc
syear_obs	start year of observation data
eyear_obs	end year of observation data
syear_his	start year of historical period
eyear_his	end year of historical period
syear_scn	start year of climate change scenario
eyear_scn	end year of climate change scenario
OWrite	Flag for overwriting output files (T: Overwrite, F: Skip)
SRadiation	Flag for calculating solar radiation (T: Calculate, F: Skip)

**Examples**

```

## Not run:
## Step 0. Load sample project
rSQMSampleProject()

## Step 1. Set working environment
EnvList <- SetWorkingEnvironment(envfile = "rSQM.yaml")

## Step 2. Load climate scenario data
LoadCmip5DataFromAdss(dbdir = EnvList$dbdir, NtlCode = EnvList$NtlCode)

## Step 3. Extract daily time series
DailyExtractAll(
  cmip5dir = EnvList$cmip5dir,
  stndir = EnvList$stndir,
  stnfile = EnvList$stnfile,
  qmapdir = EnvList$qmapdir,
  SimAll = EnvList$SimAll,
  ModelNames = EnvList$ModelNames,
  RcpNames = EnvList$RcpNames,
  VarNames = EnvList$VarNames,
  OWrite = EnvList$OWrite)

## Step 4. Bias-correction by simple quantile mapping
DailyQMapAll(
  stndir = EnvList$stndir,
  stnfile = EnvList$stnfile,
  qmapdir = EnvList$qmapdir,
  prjdir = EnvList$prjdir,
  SimAll = EnvList$SimAll,
  RcpNames = EnvList$RcpNames,
  VarNames = EnvList$VarNames,
  syear_obs = EnvList$syear_obs,
  eyear_obs = EnvList$eyear_obs,
  syear_his = EnvList$syear_his,
  eyear_his = EnvList$eyear_his,
  syear_scn = EnvList$syear_scn,
  eyear_scn = EnvList$eyear_scn,
  OWrite = EnvList$OWrite,
  SRadiation = EnvList$SRadiation)

## End(Not run)

```

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GhcnDailyUpdate

*Update Observation Data from GHCN(Global Historical Climatology Network)*


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**Description**

When user does not have own observation dataset, one can download it from GHCN. However, not recommended since NA values are too many.

**Usage**

```
GhcnDailyUpdate(NtlCode, stndir, syear_obs, eyear_obs)
```

**Arguments**

NtlCode	2 digit country(national) code, EnvList\$NtlCode
stndir	directory where downloaded data from GHCN located, EnvList\$stndir
syear_obs	start year of observation, EnvList\$syear_obs
eyear_obs	end year of observation, EnvList\$eyear_obs

**Examples**

```
## Not run:
## You can download observation data of Myanmar(MY) from 1969 to 2005 into current working directory
GhcnDailyUpdate(NtlCode="MY", stndir=getwd(), syear_obs=1969, eyear_obs=2005)

## End(Not run)
```

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LoadCmip5DataFromAdss *Download clipped national level CMIP5 data*

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**Description**

Download clipped national level CMIP5 data from ADSS's ftp server. Apec Climate Center Data Service System

**Usage**

```
LoadCmip5DataFromAdss(dbdir, NtlCode)
```

**Arguments**

dbdir	directory where downloaded data located
NtlCode	2 digit country(national) code

**Examples**

```
## Not run:
rSQMSampleProject()
SetWorkingEnvironment(envfile = "rSQM.yaml")
LoadCmip5DataFromAdss(dbdir = EnvList$dbdir, NtlCode = EnvList$NtlCode)
## You can find the national code at www.apcc21.org

## End(Not run)
```

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ObsDataSummary	<i>ObsDataSummary</i>
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**Description**

ObsDataSummary

**Usage**

```
ObsDataSummary(obsdir, stnfile, VarNames, syear_obs, eyear_obs)
```

**Arguments**

obsdir	directory path for station information file
stnfile	file name for station information
VarNames	string vector contains variables names
syear_obs	start year of observation data
eyear_obs	end year of observation data

**Examples**

```
## Not run:
ObsDataSummary(
  "Observation Directory",
  "Station File",
  "Start yaer of observations",
  "End year of observations"
)

## End(Not run)
```

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rSQMSampleProject	<i>function to create simple environment for package tutorial</i>
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**Description**

Creates project directories in user's current working directory and load sample project data into proper path for user to perform simple tutorial.

**Usage**

```
rSQMSampleProject(verbose = TRUE)
```

**Arguments**

verbose	Logical. If false, you can skip the verbose description for the structure
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**Examples**

```
library(rSQM)
rSQMSampleProject()
## Check your working directory, you can see newly created directories and sample data being loaded.
```

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SetWorkingEnvironment *Setting project environment with external yaml file*

---

**Description**

User needs quite many arguments throughtout the process. For accomodation, one can write down yaml file with environmental arguments and by using it, everythig is done.

**Usage**

```
SetWorkingEnvironment(envfile, override = list())
```

**Arguments**

envfile	yaml file including environmental infomation
override	override

**Value**

a list object containing all environmental arguments

**Examples**

```
rSQMSampleProject()
SetWorkingEnvironment(envfile = "rSQM.yaml")

## Not run:
EnvList <- SetWorkingEnvironment(envfile = "UserCustomized.yaml")
## And this EnvList object has all the information for the all the next steps

## End(Not run)
```

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